# VESDA

## Pipe Network Installation Guide

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## Scope

The VESDA Pipe Network Installation Guide is written for those involved with the design specifications, management, installation and maintenance of VESDA systems. It is assumed that those using this guide will have knowledge of the local codes and standards. It is recommended that pipe network installers attend an approved VESDA training course.

## Document Conventions

The following typographic conventions are used in this document:

| Convention | Description |
|---|---|
| **Bold** | **Used to denote:** emphasis.<br>Used for names of menus, menu options, toolbar buttons. |
| *Italics* | **Used to denote:** references to other parts of this document or other documents. Used for the result of an action. |

The following icons are used in this document:

| Convention | Description |
|---|---|
| | **Caution:** This icon is used to indicate that there is a danger to equipment. The danger could be loss of data, physical damage, or permanent corruption of configuration details. |
| | **Warning:** This icon is used to indicate that there is a danger of electric shock. This may lead to death or permanent injury. |
| | **Warning:** This icon is used to indicate that there is a danger of inhaling dangerous substances. This may lead to death or permanent injury. |

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# Codes and Standards Information for Air Sampling Smoke Detection

We strongly recommend that this document is read in conjunction with the appropriate local codes and standards for smoke detection and electrical connections. This document contains generic product information and some sections may not comply with all local codes and standards. In these cases, the local codes and standards must take precedence. The information below was correct at time of printing but may now be out of date, check with your local codes, standards and listings for the current restrictions.

### FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, the user is encouraged to try to correct the interference by one or more of the following measures; re-orientate or relocate the receiving antenna, increase the separation between the equipment and receiver, connect the equipment to a power outlet which is on a different power circuit to the receiver or consult the dealer or an experienced radio/television technician for help.

### FDA

This Xtralis product incorporates a laser device and is classified as a Class 1 laser product that complies with FDA regulations 21 CFR 1040.10. The laser is housed in a sealed detector chamber and contains no serviceable parts. The laser emits invisible light and can be hazardous if viewed with the naked eye. Under no circumstances should the detector chamber be opened.

### FM Hazardous Applications

3611 Hazardous Approval Warning: Exposure to some chemicals may degrade the sealing of relays used on the detector. Relays used on the detector are marked “TX2-5V”, “G6S-2-5V” or “EC2-5NU”.

VESDA detectors must not be connected or disconnected to a PC while the equipment is powered in an FM Division 2 hazardous (classified) location (defined by FM 3611).

### FM Approved Applications

The product must be powered from VPS-100US-120 or VPS-100US-220 only.

### ONORM F3014

ONORM F3014, transport times for all tubes (including capillaries) must not exceed 60 seconds from any hole. This means that the pre-designed pipe networks that include capillaries cannot be used.

### AS1603.8

The performance of this product is dependent upon the configuration of the pipe network. Any extensions or modifications to the pipe network may cause the product to stop working correctly. You must check that ASPIRE2 approves alterations before making any changes. ASPIRE2 is available from your VESDA ASD distributor.

### AS1851.1 2005

Maintenance Standards. Wherever this document and the AS1851.1 differ, AS1851.1 should be followed in preference to this document.

### European Installations

The product must use a power supply conforming to EN54: Part 4.

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# 1 Introduction

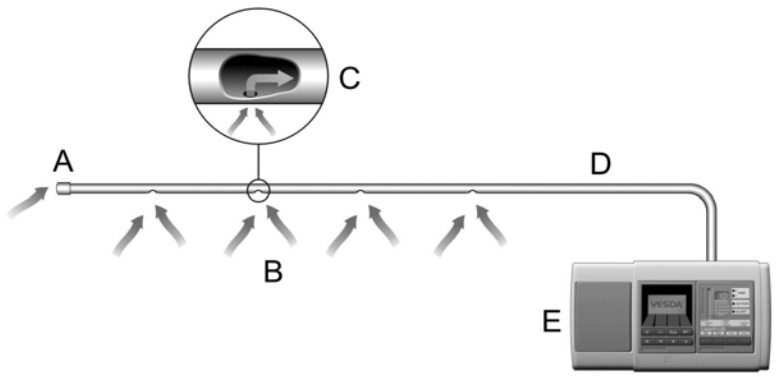
The VESDA system is an aspirated smoke detection system. It is dependent upon a properly designed and installed air sampling pipe network. Pipe network design is explained in the VESDA Pipe Network Design Guide. This guide instructs the reader on how to install an efficient air sampling pipe network. It informs the reader about the components used in a pipe network Installation and guidelines in their application. Procedures for some of the more common installations are explained.

Installation should be performed after the site survey and ASPIRE2 modelling have finished. Once the installation is finished you can move on to commissioning the VESDA system.

This step requires you to install the pipework as specified in design documents and record any changes to the plan that you are required to make. These details will be included in the hand-over documentation which will be given to the customer when the system is commissioned.

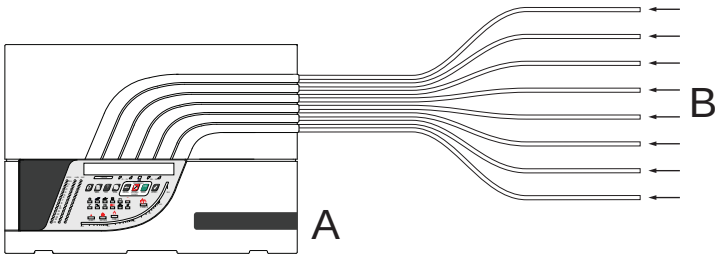
## 1.1 Pipe Network

The VESDA early warning aspirating smoke detection system collects air samples through sampling holes on a network of pipes. The airflow within a protected area carries the air samples to the sampling holes. Conventional smoke detectors wait for the smoke to migrate through the detector, VESDA actively draws air samples into the sampling system. These samples are transported through the pipe network to the detector.




| Legend | |
|---|---|
| **A** | End Cap with hole |
| **B** | Air samples |
| **C** | Airflow entering a sampling hole |
| **D** | Air sampling pipe |
| **E** | Detector |

Figure 1-1: VESDA air sampling system using pipes




| Legend | |
|---|---|
| **A** | Detector |
| **B** | Microbore tubes |

Figure 1-2: VESDA VFT-15 air sampling system using Microbore tubes

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# 2 Installation Steps

These instructions are the basic sequence of steps you will be required to perform when installing a pipe network. Information on installing into a range of environments is covered in depth in Chapter 5. Information on the theory of good pipe network design can be found in the VESDA Pipe Network Design Guide.

## 2.1 Pipe Network Installation

The normal procedure for installation is:

1. Check the design documents to gather information on the size and configuration of the pipes. The design documents could include pipe network design specifications, an ASPIRE2 Installation Data Pack (IDP), or a pre-engineered design.
2. Mark the spots where the detector is to be installed.
3. Measure and mark the spots for pipe mounting clips as per the design documents.
4. Install the detector. For further information refer to the detector documentation.
5. Install the mounting clips as per the design documents.
6. Mount and join the pipes onto the clips, as per the guidelines in Section 4.4. Do not glue the pipes at this stage.
7. Drill sampling holes in the pipe ensuring that the spacing between sampling holes is as per the design documents and the holes are at the correct orientation.
8. Check if the design documents require end caps with holes. Install as required.
9. Run the pipe to the detector.
10. Insert the pipes into the detector ensuring there is a minimum of 500 mm (20 in.) of straight pipe before the pipe enters the detector. Do not glue the pipes to the detector manifold.
11. Update the design documents with any changes that may have been made to the original plan. If the installed system is significantly different to the original plan you may need to use ASPIRE2 to check that the new design will actually work.
12. After all the tests have been completed bond the pipes together using the appropriate cement solvent. Do not glue the pipes running into the detector manifold, as this can make it impossible to service the detector, and will void the warranty.
13. Use appropriate labels and tag the sampling pipe and sampling holes.
14. Update the design documents with any further changes that may have been made during the tests, and give a copy of the updated design documents to the person who will be commissioning the system.

## 2.2 Microbore Tube Network Installation

**Note:** For reliable smoke detection and flow monitoring performance, the VESDA VFT-15 detector must be connected to a balanced network containing equal length Microbore Tubes of 50 m (164 ft). Where the distance between the detector and sampling hole is less than 50m (164ft), refer to the VESDA VFT-15 Product Guide for information on using a combination of reduced diameter Microbore Tubes and reducing connectors to achieve the required system performance.

The following instructions provide the basic sequence of steps when installing a microbore tube network for use with the VESDA VFT-15 detector:

1. Check the design documents to gather information on the location of sampling points. Update the design documents with any changes that may have been made to the original plan.
2. Mark the spot where the detector is to be installed.
3. Install the detector. For further information refer to the detector Product Guide or Installation Sheet.
4. Insert the microbore tubes into the detector. Do not glue the microbore tubes to the detector manifold.
5. Run the microbore tubes to the required sampling locations ensuring there are no kinks. It is recommended that excess tubing be coiled close to the sampling point end. Check if the design documents require sampling point components. Refer to Section 3.9 on page 9. Install as required.
6. Unused inputs on the detector should be looped to one another using short lengths of microbore tubes. For example, if the VESDA VFT-15 detector has unused inputs 9 to 15, one way of connecting the unused inputs would be to use short pieces of microbore tubes to connect inputs 9 to 12, 10 to 13, 11 to 14 and have input 15 capped off.

7. Update the design documents with any further changes that may have been made during the tests, and give a copy of the updated design documents to the person who will be commissioning the system.

**Caution:** Do not insert ANY object into the inlet ports other than the correct size of tubes. Doing so may cause damage to the delicate electronic flow sensor components mounted just inside each port opening, and void the warranty.

# 3 Components of a Pipe Network

This section describes various components used in constructing a pipe network and guide lines that should be observed in using these components. It is unlikely that all the components mentioned here will be used in every installation and some projects may require components other than those mentioned here.

## 3.1 Pipe Line

The sampling pipe used for the pipe network is normally a low cost 19 mm to 25 mm (0.75 to 1 in) ID PVC pipe. We recommend the use of 21 mm (0.83 inch) ID, smooth bore pipe. The internal diameter for the pipes may vary depending upon design requirements. The sampling pipe used must also comply with local codes and standards.

Figure 3-1: A section of VESDA pipe

## 3.2 Microbore Tube

Sampling for the VESDA VFT-15 detector is achieved through flexible microbore tubes.

The VESDA VFT-15 detector requires that each microbore tube has a fixed length of 50m (164 ft), 6mm (0.24”) OD, 4mm (0.16”) ID and comprises one sampling point at the end. It is recommended that excess microbore tube be coiled near the sampling point end and for good aesthetic practice be run through the roof or floor spaces.

**Note:** For reliable smoke detection and flow monitoring performance, the VESDA VFT-15 detector must be connected to a balanced network containing equal length Microbore Tubes of 50 m (164 ft). Where the distance between the detector and sampling hole is less than 50m (164ft), refer to the VESDA VFT-15 Product Guide for information on using a combination of reduced diameter Microbore Tubes and reducing connectors to achieve the required system performance.

## 3.3 Couplings, Socket Unions and Expansion Joints

Couplings, socket unions, and expansion joints are used to connect pipes together.

A.

B.

Figure 3-2: Coupling joint (A) and socket unions (B)

For information on expansion joints, refer to Section 4.3 on page 13.

Couplings are the usual way to connect two pieces of pipe.

Socket unions are typically used where the pipes may have to be periodically dismantled for maintenance. Socket unions are also used where it is important to have the correct orientation of sampling holes, for example, sampling pipes over air grilles.

Expansion joints are used in environments where pipes are likely to expand and contract due to variation in temperature, for example, sampling pipes in refrigerated warehouses.

## 3.4 Bends and Elbows

Bends and elbows are used to change the direction of the pipe. Bends having a wider radius are preferred, though elbows are also acceptable.

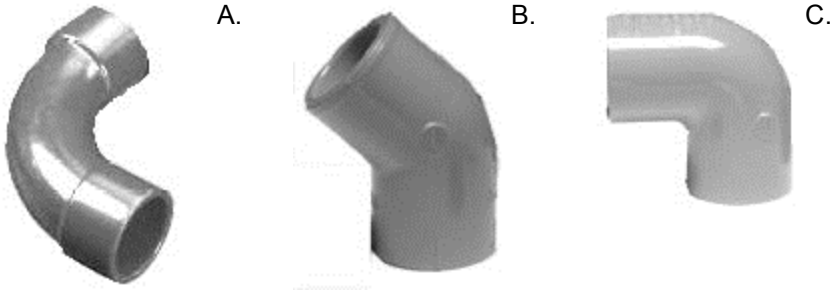



Figure 3-3: A wide radius bend (A), 45° bend (B), and 90° elbow (C)

## 3.5 Tees, Y-Pieces and J-Pieces

Tees, Y-Pieces and J-Pieces are used for branching a sampling pipe or for attaching capillaries and drop pipes to the air sampling pipe.

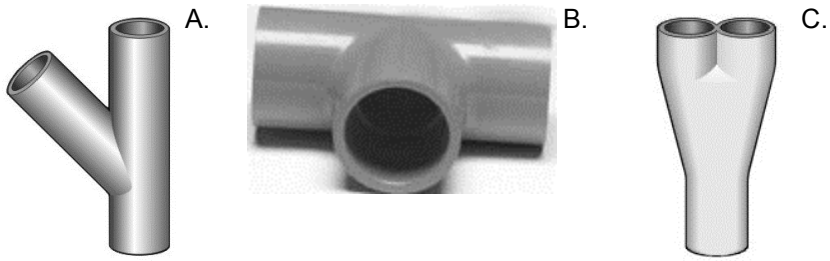



Figure 3-4: Y-Piece (A), Tee (B) and J-Piece (C)

**Note:** It is important that the air sampling pipe is branched in the direction away from the detector.

## 3.6 Reducing Connectors

Reducing connectors are used to attach pipes having different internal/outer diameters. These are typically used to connect capillary tubes and drop pipes to the sampling pipe.

Figure 3-5: Reducing Connector

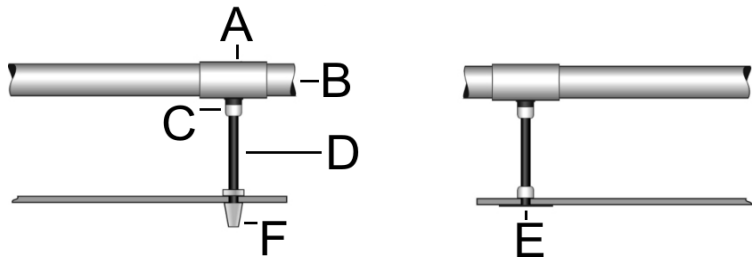
## 3.7 Pipe Adaptors

The pipe adaptor is used to connect imperial size pipes to the detectors pipe Inlet manifold. All detectors shipped to U.S.A. include pipe adaptors where applicable.

Figure 3-6: Pipe Adaptor

## 3.8 Capillary Tubes and Drop Pipes

Capillary tubes are lengths of flexible tubing that are connected to the sampling pipe. Capillary tubes are typically used to sample air away from the air sampling pipe, or in instance where focused air sampling is required. Capillary sampling is used for in-cabinet sampling and in instances where the sampling pipe requires to be concealed from the sampling area. Drop pipes are a variation of the capillary tube and serve the same purpose.




| Legend | |
|---|---|
| **A** | Tee adaptor |
| **B** | Sampling pipe |
| **C** | Reducing connector |
| **D** | Capillary tube |
| **E** | Flush sampling pint |
| **F** | Miniature sampling point |

## 3.9 Miniature Sampling Points

Miniature sampling points are attached to the sampling end of capillary tubes. There are two types of miniature sampling points:

**Conical sampling points**

Local codes and standards normally specify the minimum distance from the ceiling for air sampling. The conical sampling points meet these requirements and is more commonly selected as a miniature sampling point.

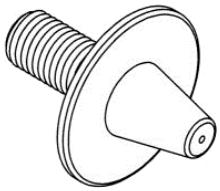


Figure 3-7: Conical Sampling Point

**Flush Sampling Points**

Flush sampling points are normally used when there is a need to conceal the pipe network. Flush sampling points may not comply with your local codes and standards. These are mostly used for performance based systems.

Figure 3-8: Flush Sampling Point

## 3.10 Microbore Sampling Points

Microbore sampling points are attached to the end of the flexible microbore tubing and can be used for capillary tubes that are of the same size.

**Note:** Ensure the same type of sampling points is used for all microbore tubing connected to a single detector.

**Sintered End of Line Filter**

It is recommended that a sintered end of line filter is used at the end of every capillary tube. This will ensure that airflow is not impeded by blockages such as insects nesting within the capillary tube.

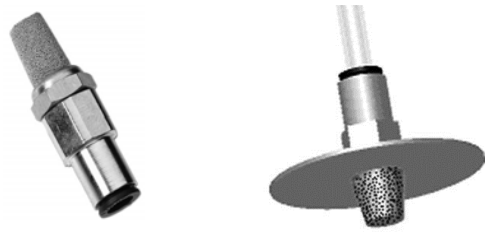


Figure 3-9: Sintered End of Line Filter

**Flush End of Line Filter**

This type of sampling point provides both a sturdy, safe and aesthetically pleasing end point. It can be screwed to walls or ceilings while the small maze grid over the sampling hole acts as a filter.

Figure 3-10: Flush End of Line Filter

## 3.11 Mounting Fixtures

The sampling pipe is mounted using the appropriate pipe mounting options. Some of the mountings commonly used are illustrated below:

Figure 3-11: Pipe mounting fixtures (pipe clips, self-locking ties, saddle strap)

## 3.12 Solvent Cement

Solvent cement is used to bond pipes together. It may also be used to bond pipe accessories such as couplings, socket unions, bends, elbows, tees, Y-pieces, J-pieces, and end caps to the pipe.

## 3.13 Labels

Sampling point labels – There are two labels to identify sampling holes:

- **Miniature sampling point label:** These are round labels with a hole in the center to fit around the miniature sampling points. Refer to Figure 3-12.
- **Sampling point decal:** This decal is wrapped around a pipe on the sampling hole. The decal has a hole in the center. The hole in the decal must be aligned to the sampling hole drilled into the pipe. Refer to Figure 3-13.
- **Pipe label:** This label identifies the pipe as being a smoke detector pipe and warns against tampering with it. Refer to Figure 3-14.
- **Test Point label:** This label identifies a sampling point which is used for test purposes. It is normally the last sampling point on the main pipe or branch pipe. Refer to Figure 3-15.

Figure 3-12: Miniature Sampling Point label

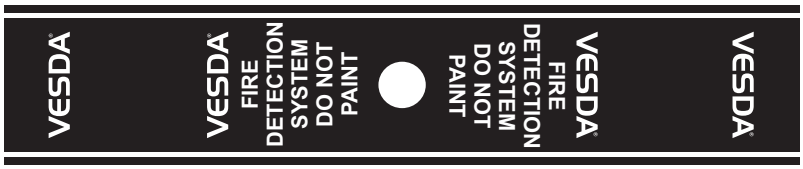



Figure 3-13: Sampling Point decal

Figure 3-14: Pipe label

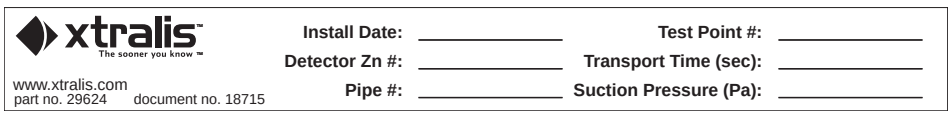



Figure 3-15: Test Point label

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# 4 Working with Pipes

The following guidelines will assist with the successful installation of a pipe network:

## 4.1 Cutting Pipes

If the pipes need to be cut use the right tools to cut the pipe. Use pipe cutting shears or wheel type plastic tube cutter. It is important that the cutting edge of the shears and cutter are sharp. Ensure that the cut is square. Square cuts provide maximum bonding area. Remove all loose plastic. Beveling the end will make it easier to fit in to the socket and prevent solvent cement from being wiped from the joining surface during final assembly.

Figure 4-1: Pipe Cutting Shears

**Note:** Remember to remove all dust and shavings created when cutting the pipe as they can block sampling holes and impacts on the efficient performance of a pipe network.

## 4.2 Joining and Bonding

When joining the pipes ensure that the pipes are inserted all the way to the “lip” inside the coupling or adaptor. Failing to do so will create a turbulence due to expansion of space between the pipe end and the coupling lip.

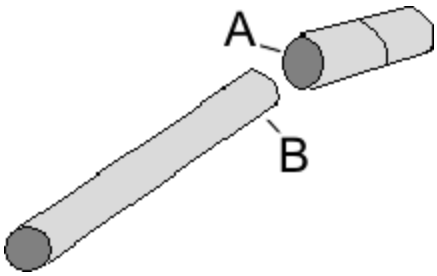
Figure 4-2: Turbulence created due to a gap in pipe coupling

All joints (except the joint to the detector) should be bonded using appropriate solvent cement. It is advisable to bond the joints only after the final tests have been completed and required adjustments have been made.

## 4.3 Cementing Pipes Together

Bonding, cementing or gluing pipes is all done using the same process. Apply your glue/cement/bonding agent to the outside of the pipe and insert into the other pipe. If you were to put it on the inside of a pipe, it will build up when the other pipe is inserted. This build-up will affect the airflow characteristics inside the pipe and may cause unpredictable behavior.

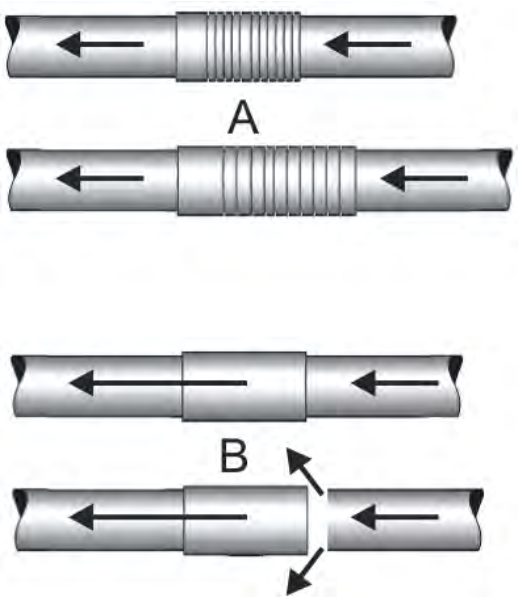
You should never bond, glue or cement the pipes that connect to the detector.




| Legend | |
|---|---|
| **A** | Do not apply solvent cement on the inside |
| **B** | Apply solvent cement on the outside |

Figure 4-3: Applying solvent cement

Where there is likelihood of high level of temperature fluctuations, use expansion joints or U bends to allow for the expansion and contraction of pipes.




| Legend | |
|---|---|
| **A** | Expansion joint |
| **B** | Standard pipe joint |

Figure 4-4: Expansion joints

The diagram above shows expansion (A) and standard (B) pipe joints. The diagrams at the top show how the pipe network will look at room temperature, the diagrams at the bottom show what happens after the refrigeration system has been turned on and the pipe shrinks. Note that once the standard pipe has shrunk the pipes are no longer air tight and the detector will not be able to detect smoke.

**U bend arrangement**

It is important to allow for the expansion or contraction of the sampling pipes where there is likelihood of high level of temperature fluctuations. It is recommended to use 'U' bends in longer pipe runs to prevent buckling. Refer to Figure 4-5.

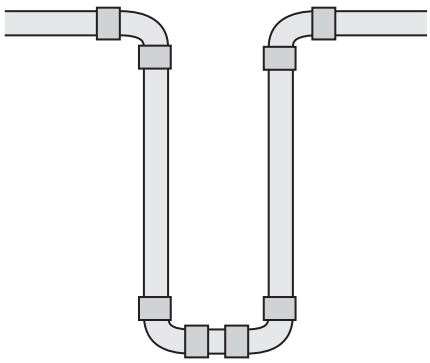


Figure 4-5: U bend

## 4.4 Mounting

The pipe network should be mounted as per the design and ASPIRE2 specifications. The fittings used for mounting will depend upon the design and site requirements.

- To minimize flexing the pipes should be secured every 1.5 m (5 ft.)
- Pipes should be suspended between 25 -100 mm (1 - 4 inches) below the ceiling
  **Note:** This is subject to local codes and standards and pipe network design specifications.
- Where expansion or contraction of pipes is likely either after installation or on a continuous basis, place pipe clips 0.5m (1.5 ft) away from any bends, couplings and socket unions as these may interfere with the movement of the pipe. It is recommended to use appropriate pipe supports which don't clamp securely around the pipe, thus allowing the pipe to freely expand and contract within.
- Refer to Chapter 5 for details on mounting requirements for specific types of installations.

## 4.5 Bending Pipes

Whenever possible, use the appropriate precast pipe bends. Where no precast bends are available pipes can be bent within certain limits to change pipe direction or to go around small obstructions. When bending a pipe:

- Use Bending springs
- Use Pipe Benders
- Do not bend on sharp objects or heat the pipe
- Replace any pipe bends that have kinks

The ASPIRE2 modelling software is used to test if a proposed pipe network will meet customer and local authority codes and standards. Bends that are not entered onto the design will cause there to be differences between the expected pipe network performance, and the performance that will be tested during commissioning. If the changes are too great the commissioning engineer will have to investigate and may require that pipework to be replaced to meet the original specification.

## 4.6 Drilling Sampling Holes

Sampling holes are drilled into the pipes once the pipe network is installed.

- The ASPIRE2 Installation Data Pack (IDP) coordinates the positions of the sampling holes.
- Drill sampling holes at the positions marked in the IDP.
- The IDP will specify the diameter required for each sampling hole on the grid.
- It is important that correct diameter sampling hole is drilled as the hole size effects the performance efficiency of the VESDA System. The size of sampling holes may be different for each hole in a pipe network so check the size required for each hole in the IDP.
- Holes MUST be drilled at 90° to the pipe. If the drill is at an angle, the sampling hole will not be round and may effect air flows.
- The hole must only be into the pipe and not through the other side of the pipe.
- The sampling hole should be drilled at slow drill speed with a sharp drill bit, to avoid dust, debris or burrs enter the sampling pipe.

## 4.7 Labelling

Adhesive labels to identify the sampling pipe and the sampling holes and Sampling Points are available from Xtralis. These should be used to identify:

- The Pipes as Smoke Detector sampling pipes
- Sampling Holes
- Sampling Points
- Test Points

For further information on the different label types, refer to Section 3.13 on page 11.

## 4.8 Using Capillaries, Microbore and Drop Pipes

## 4.9 Using Capillaries and Drop Pipes

Typically a capillary is a flexible tubing having a maximum length of 8 m (26.25 ft.). To maintain an acceptable level of air flow we recommend the use of 21 mm (0.83 inch) ID pipe for drop pipes. The minimum capillary ID is 4 mm (0.2 inch). A variation of the capillary tube is the 12.5 mm (half inch) ID rigid drop pipe. Drop pipes of up to 4 m (13 ft.) are acceptable, but should be verified against ASPIRE2 calculations.

Where multiple capillary tubes are used, the length for each capillary should be approximately the same. A sampling hole (suggested 2 mm (0.079 in.) diameter) is required at the end of each capillary tube or drop pipe.

All capillary tubes which are close to the limits suggested above should be checked by ASPIRE2 before installation.

Installations using microbore (for the VESDA VFT-15) are similar to installations using capillaries, but only require the microbore tubing to be run to the sampling point and a microbore sampling point fitting. The VESDA VFT-15 detector requires that each microbore tube has a fixed length of 50m (164 ft), 6mm (0.24”) OD, 4mm (0.16”) ID and comprises one sampling point at the end. It is recommended that excess microbore tube be coiled near the sampling point end and for good aesthetic practice be run through the roof or floor spaces.

**Note:** For reliable smoke detection and flow monitoring performance, the VESDA VFT-15 detector must be connected to a balanced network containing equal length Microbore Tubes of 50 m (164 ft). Where the distance between the detector and sampling hole is less than 50m (164ft), refer to the VESDA VFT-15 Product Guide for information on using a combination of reduced diameter Microbore Tubes and reducing connectors to achieve the required system performance.

# 5 Installing Pipe Networks

Pipe network designs are specific to a site and are dependant upon site conditions, the application, customer requirements and local codes and standards. Installing pipe networks requires knowledge of the components used, guidelines that should be followed, and an understanding of the more commonly used air sampling options. For information on the theory of pipe networks refer to the VESDA Pipe Network Design Guide.

This section of the manual contains the instructions for installing pipe networks into the common types of sites. For information on installing pipe networks to specialized environments refer to the VESDA Application Design Guides.

## 5.1 Ceilings and Floors

### 5.1.1 On Ceiling

On-Ceiling installation is the most common type of installation and is often installed in a standard room not having any special requirements. The pipes are installed directly onto the ceiling of the area to be protected.

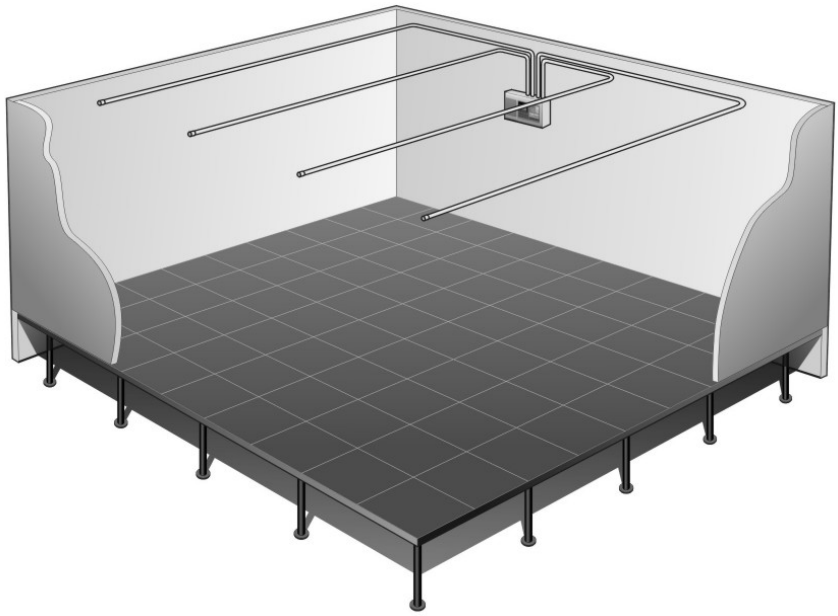


Figure 5-1: Typical on-ceiling installation

**The normal procedure for installing an on-ceiling pipe network is:**

1. Check the design documents to gather information on the size and configuration of the pipes. The design documents could include pipe network design specifications, or an ASPIRE2 Installation Data Pack (IDP) or a pre-engineered design.
2. Mark the spot where the detector is to be installed.
3. Measure and mark the spots for pipe mounting clips as per the design documents.
4. Install the detector. For further information refer to the detector documentation.
5. Secure the pipe mounting clips to the ceiling ensuring that the distance between the ceiling and the pipe is according to the design documents.
6. Mount and join the pipes onto the clips, as per the guide lines in Section 4.4 on page 14. Do not glue the pipes at this stage.
7. Drill sampling holes in the pipe ensuring that the spacing between sampling holes is as per the design documents and the holes are at the correct orientation.
8. Check to see if the design documents require end caps with holes. Install as required.
9. Run the pipe to the detector.
10. Insert the pipes into the detector ensuring there is a minimum of 500 mm (20 in.) of straight pipe before the pipe enters the detector. Do not glue the pipes to the detector manifold.

11. Update the design documents with any changes that may have been made to the original plan. If the installed system is significantly different to the original plan you may need to use ASPIRE2 to check that the new design will actually work.
12. After all the tests have been completed bond the pipes together using the appropriate cement solvent. Do not glue the pipes running into the detector manifold, as this can make it impossible to service the detector, and will void the warranty.
13. Use appropriate labels and tag the sampling pipe, sampling holes and test points where required.
14. Update the design documents with any further changes that may have been made during the tests.

### 5.1.2 In-Ceiling Installation

In-Ceiling installations are pipe networks in the ceiling void between the roof of the building and the false ceiling panels.

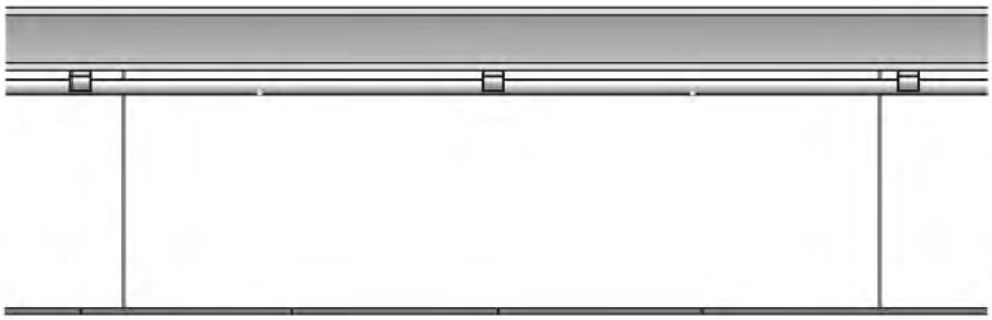


Figure 5-2: Typical installation in a ceiling void

1. Check the design documents to gather information on the size and configuration of the pipes. The design documents could include pipe network design specifications, or an ASPIRE2 Installation Data Pack (IDP) or a pre-engineered design.
2. Mark the spot where the detector is to be installed.
3. Identify and measure the spots for securing the pipe as required by the design documents and guidelines for mounting pipes. Refer to Section 4.2 on page 14. Ceiling joists and/or support beams can be used to secure the pipe.
4. Install the detector. See the detector documentation for details.
5. Secure the pipe using appropriate conduit clamps or self locking ties ensuring that the distance between the roof and the pipe is according to the design specifications. For further information refer to Section 3.11 on page 10.
6. When securing the pipes follow the guidelines discussed in Section 4.2 on page 13. Do not glue the pipes at this stage. Special attention needs to be given to the expansion and contraction of pipes in ceiling voids, as the pipes are likely to be subjected to a higher level of temperature fluctuations. In areas of wide temperature fluctuations, it is strongly suggested that expansion Joints are used to counter the higher rates of expansion and contraction of the sampling pipe.
7. Drill sampling holes on the underside or side of the pipe ensuring that the spacing between sampling holes is as per the design documents and the holes are at the correct angle.
8. Check to see if the design documents requires end caps with a hole. Install as required.
9. Run the pipe to the detector.
10. Insert the pipes into the detector pipe inlet manifold. Refer to the relevant detector manual for further information.
11. To avoid potential effects of pressure differentials it is recommended that sampled air is exhausted from the detector back to the ceiling void.
12. Mark the design documents with any changes that may have been made during installation.
13. After all the tests have been completed bond the pipes together using the appropriate cement solvent. Do not glue the pipes running into the detector manifold, as this can make it impossible to service the detector, and will void the warranty.
14. Use appropriate labels and tag the sampling pipe, sampling holes and test points where required. Refer to Section 3.13 on page 11.
15. Mark the design documents with any further changes that may have been made during the tests.

### 5.1.3 Floor Void Installation

Installations in the under floor void require considerations similar to the In-Ceiling Void Installation.

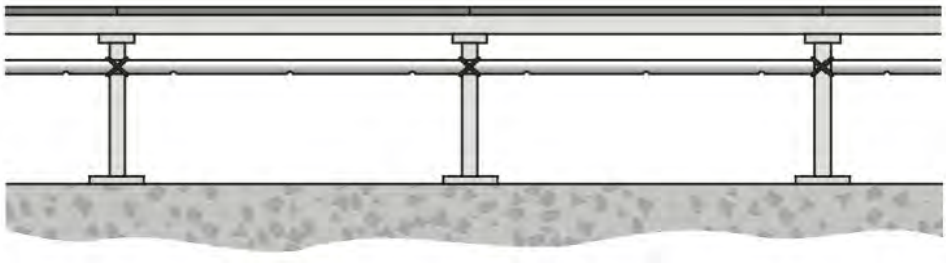


Figure 5-3: Typical under floor installation

**The Guidelines to be followed for Floor Void Installations include:**

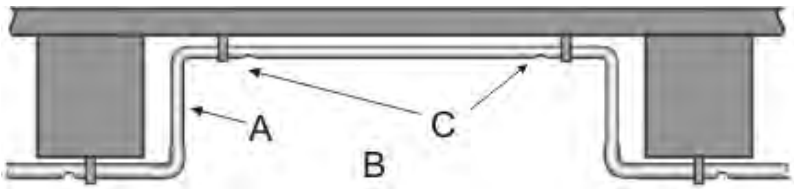
1. Refer to the guidelines for In-ceiling installations for general guidelines.
2. Supporting posts can be used to secure the pipe.
3. As the initial smoke layer normally takes up the top 10% of the void height, pipes should be placed as close to the floor as possible.
4. Secure the pipe using appropriate conduit clamps or self locking ties ensuring that the distance between the floor and the pipe is according to the design specification. For further information, refer to Section 3.11 on page 10.

### 5.1.4 Inter-beam

Inter-beam sampling is used in areas having large beams as defined by local fire code and standards, or as per site requirements. Design documents will specify the requirement for inter-beam sampling.

**The three methods for inter-beam sampling are:**

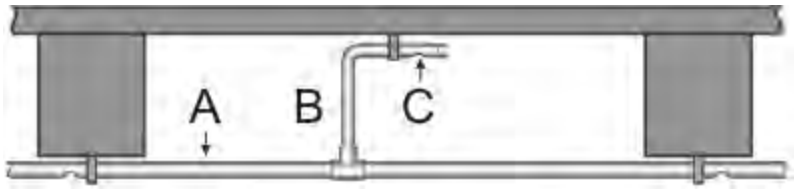
**Sampling Pipe Traversing inside of the Beam Pocket -** Bend the sampling pipe, where the depth of the beam allows the pipe to be bent without it cracking or crinkling (refer to Section 4.5 on page 15).




| Legend | |
|---|---|
| **A** | Sampling Pipe |
| **B** | Beam Pockets |
| **C** | Sampling holes |

Figure 5-4: Inter-beam sampling using pipe bends

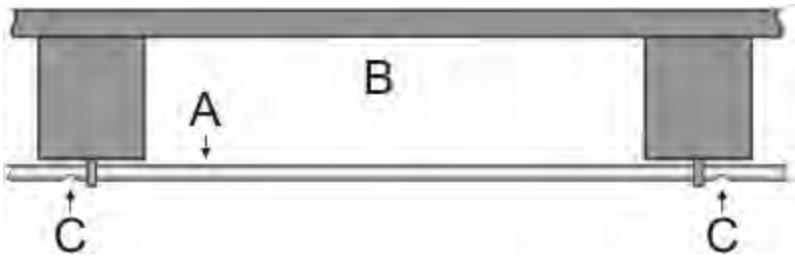
**Walking Sticks -** Walking sticks are attached to the sampling pipe. The walking stick is a length of riser pipe. Attach a bend or an elbow at the top end of the riser pipe. Fix an appropriate length of pipe to the bend or elbow and drill a sampling hole (as specified in the design documents) into the pipe. Close the end of the pipe with an end cap. Attach the walking stick to a Tee adaptor using a reducing connector (if required). Join the Tee to the sampling pipe at the specified spot.




| Legend | |
|---|---|
| **A** | Sampling Pipe |
| **B** | Beam Pockets |
| **C** | Sampling holes |

Figure 5-5: Inter-beam sampling using a walking stick

**Underside of the Beams -** Run the sampling pipe with sampling holes facing down, along the underside of the beams.




| Legend | |
|---|---|
| **A** | Sampling Pipe |
| **B** | Beam Pockets |
| **C** | Sampling holes |

Figure 5-6: Inter-beam sampling

## 5.1.5 Capillary Tubes, Microbore and Drop Pipes Installation

## 5.1.6 Capillary Tubes and Drop Pipes Installation

Capillary tubes and drop pipes are used to monitor the environment from areas away from the sampling pipe. Capillary tubes and drop pipes are typically used for Concealed and In-Cabinet sampling.

**Guidelines for Capillary and drop pipes:**

1. Install the sampling pipe using Tee adaptors where the capillary tubes or drop pipes need to be attached.
2. Fix appropriate sized reducing connection to the Tee
3. Connect capillary tube or drop pipe to the reducing connector
4. Run the capillary or the drop pipe to the required sampling point
5. Attach sampling point fitting

**Note:** Microbore only requires steps 4 and 5.

## 5.1.7 Concealed Sampling

Concealed sampling is used when there is a requirement for aesthetics or for security. Capillary tubes and drop pipes are normally used for concealed sampling. The ceiling void is used to lay the sampling pipe. Capillary tubes are routed to the required location and penetrate the ceiling, generally using something to hide the tube. The end of the tube is either restricted with a capillary cap or left fully open.

In situations where discreet sampling is required to maintain the aesthetics of the protected area, the capillary tube can be concealed behind a ceiling rose, wound down a chandelier support chain or can sit flush with the ceiling cornice. The sampling holes can be concealed by using a flush sampling point or a sampling point inserted inside the end of the sampling pipe.

1. Follow the guidelines in Section 5.1.2 on page 18.
2. Then follow the guidelines in Section 5.1.5 on page 20.

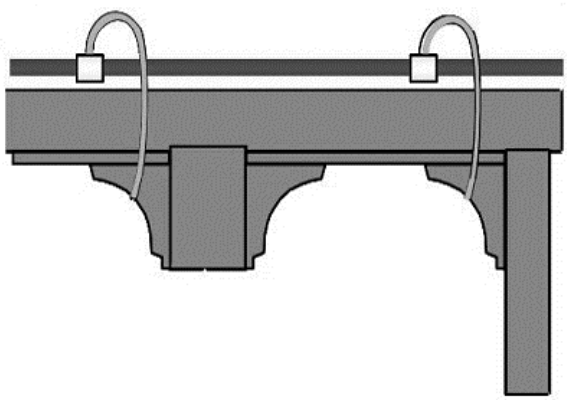


Figure 5-7: Concealed sampling points

# 5.2 Return Air Grilles and Air Ducts

## 5.2.1 Return Air Grilles

Return air grille sampling is used to monitor the grille air drawn to an exhaust ventilation system or to an air handling unit (AHU). The pipe network design will specify where return air sampling is required.

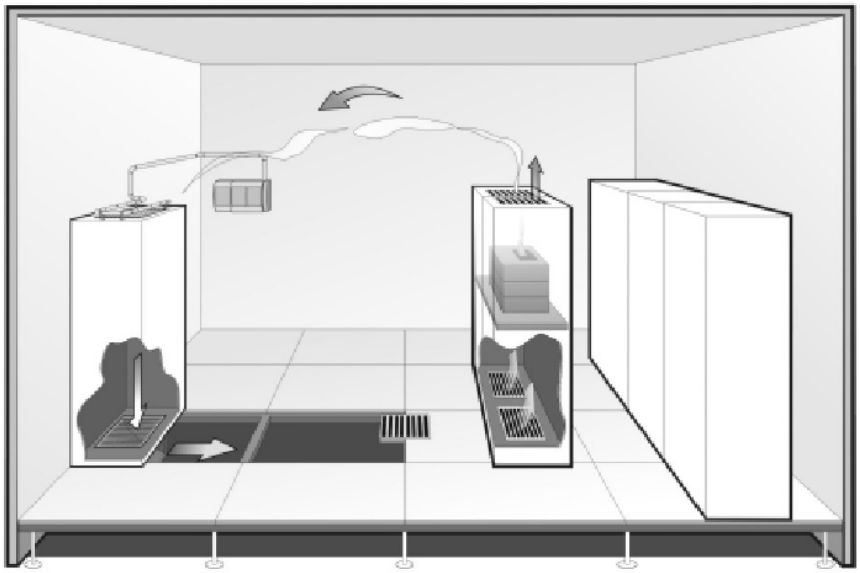


Figure 5-8: Return air grille sampling

The guidelines that need to be considered in a return air grille sampling installation:

1. Follow the guidelines specified in Section 5.1 on page 17 then use the guidelines below.
2. Fix appropriate pipe mounting clips or pipe clamps with standoff posts over the return air grille.
3. Sampling pipes on return air grilles having high velocity air flows which may require mounting on standoff posts to keep the sampling pipe 25 mm to 200 mm (1 to 8 inches) away from the grille. Refer to the pipe network design for requirements.

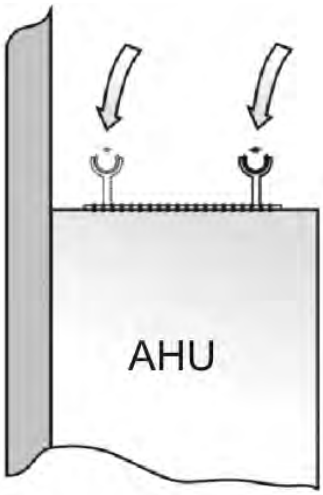


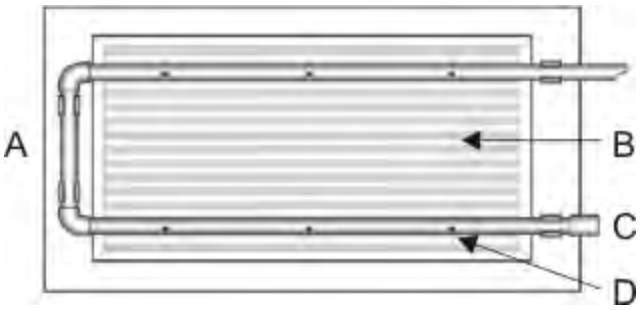

Figure 5-9: Pipe position on a return air grille

Return air grilles may be removed and replaced for maintenance. To ensure the orientation of sampling holes are maintained at the correct angle once the air grille is replaced:

- Cut sampling pipe of specified diameter to the length of the air grille.
- Fix appropriate pipe mounting clips or pipe clamps with standoff posts over the return air grille.

4. Connect the sampling pipe using socket unions and do not glue them in place. The socket unions must be between the end of the air grille and the mounting clips or pipe clamps. Refer to Figure 5-9 for details.

Generally, a VESDA VLP or VESDA VLS detector should not monitor more than four AHUs, a VESDA VLC should not monitor more than two, and a VESDA VLF should not monitor more than one AHU.




| Legend | |
|---|---|
| **A** | Sampling Pipe |
| **B** | Return grille |
| **C** | End cap without a hole |
| **D** | Sampling hole |

Figure 5-10: Sampling over a return air grille

5. Drill sampling holes as specified in the design documents.
6. The pipework must always have an end cap without a hole in it.

## 5.2.2 Supply Air Sampling

Refer to Return Air Grilles (Section 5.2.1), or use a Duct design (Section 5.2.3).

### 5.2.3 Duct Sampling and Condensation

Duct sampling allows you to monitor the return and supply air within the protected enclosure. The sampling pipe is connected to a sampling probe to sample the air from within the duct. To avoid the potential effects of pressure differentials the air is exhausted back into the duct through an exhaust probe. The exhaust probe holes must also face the same direction as the intake probe holes.

The detector must be installed in the inverted position when sampling air from ducts. This is done because condensation may occur when the dew point temperature of the duct air is at or above the ambient temperature of the detector. This usually occurs when the temperature of the humid duct air is higher than the ambient temperature of the detector.

In this situation, longer pipe runs outside the duct should be used. Initial regular inspections must be carried out to determine whether there is condensation forming inside the pipes, especially during the winter season. Smoke tests should be conducted regularly in the first two months of installation.

**Duct Installation Considerations**

- In air-return ducts, the detector must be installed where the static pressure is not below -500Pa and the air duct velocity is not above 20 m/sec (4,000 fpm). Static pressure is the pressure generated by the fan to deliver a specific flow-rate in the duct. Static pressure is a function of the flow-rate and impedance of the duct system. Convert to volumetric flow rate.
- Always vent the exhaust pipe back into the duct even when the duct pressure is sometimes very small (e.g. less then 20Pa). This is because the duct system operation may change in the future.
- In air-return (negative pressure) ducts, the detector must be installed away from any fans and closer to air vents; this reduces large negative pressures.
- For air-return (negative pressure) ducts, the detector must be installed before humidifiers, heating coils, and filters.
- In air-return (negative pressure) ducts, the detector must be installed before fresh air intakes.
- Do not sample from multiple ducts (i.e. use a different detector for each duct).
- Do not sample duct and ambient environments together.
- For a detector mounted on the duct, ensure no tangible vibrations exist when the duct system is in full operation. If vibrations exist, insert visco-elastic foam between the detector's mounting bracket and the external surface of the duct.

**Probe Installation**

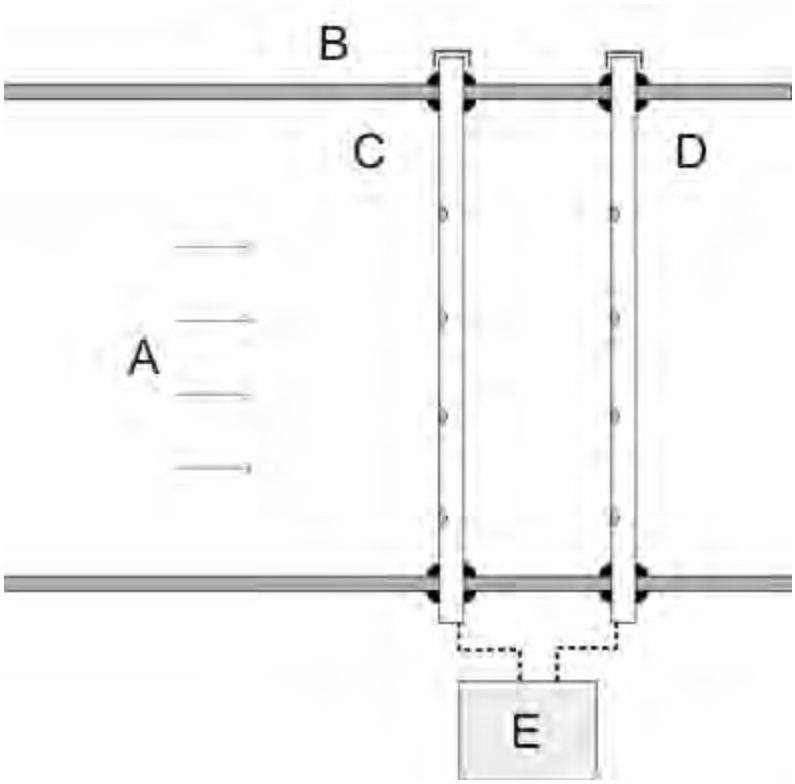
The differential pressure across the inlet and exhaust pipe needs to be kept within ±10Pa in the presence of airflow, regardless of duct air velocity.

Differential pressure is created by the orientation of the holes on both pipes in relation to the duct flow. This differential pressure across the inlet and exhaust pipes will either aid or impede the flow through the detector.

A very low differential pressure ensures the normal operation of the detector. To achieve this, perform the following steps:

1. Ensure the duct system is operating and airflow is present in the duct.
2. Drill holes in the inlet and exhaust pipes as required, draw a line along the holes to the end of the pipe.
3. Insert the pipes in the duct, and rotate the pipe until the line indicates that the holes are facing into the airflow
4. Using the Manometer testing (Figure 5-11) or flexible U testing (Figure 5-12) methods to minimize the pressure differential.
5. When you are happy with the pipe orientation, mark the position of the pipes' orientation on the duct and pipes.
6. Secure the pipe installation and run pipe to the detector.

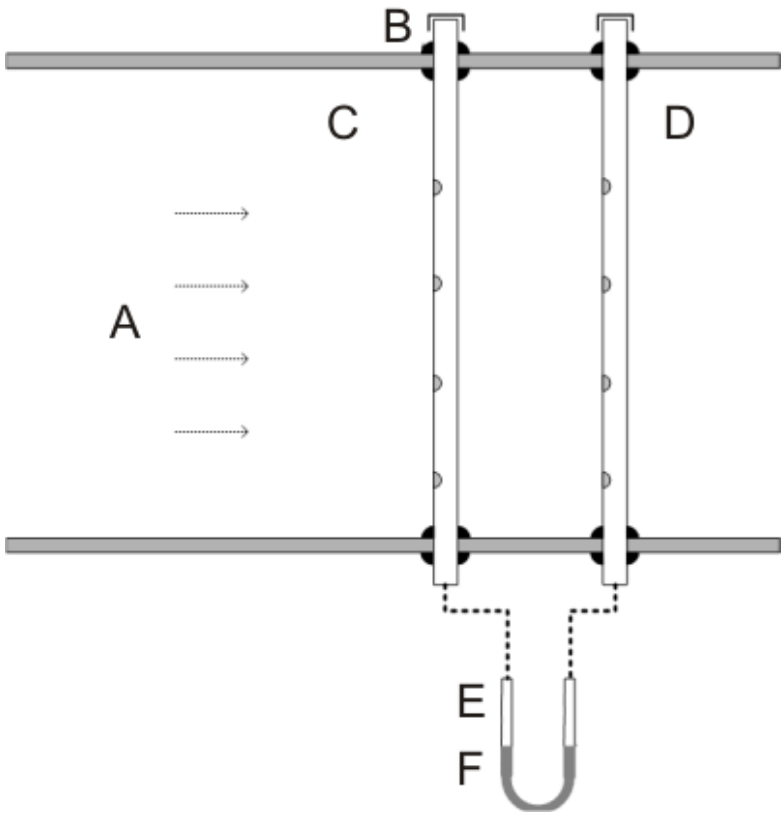
Face the holes of both pipes to the airflow and slightly rotate the pipes so the pressure reading is within ±10Pa. Mark the position of the pipes' orientation on the pipe and the outside of the duct. Connect the detector after securing the pipe network.




| Legend | |
|---|---|
| **A** | Air flow |
| **B** | Rubber grommet |
| **C** | Sampling pipe |
| **D** | Exhaust pipe |
| **E** | Manometer pressure |

Figure 5-11: Manometer testing

Connect the pipe ends to a U-shape clear flexible tube that contains water.



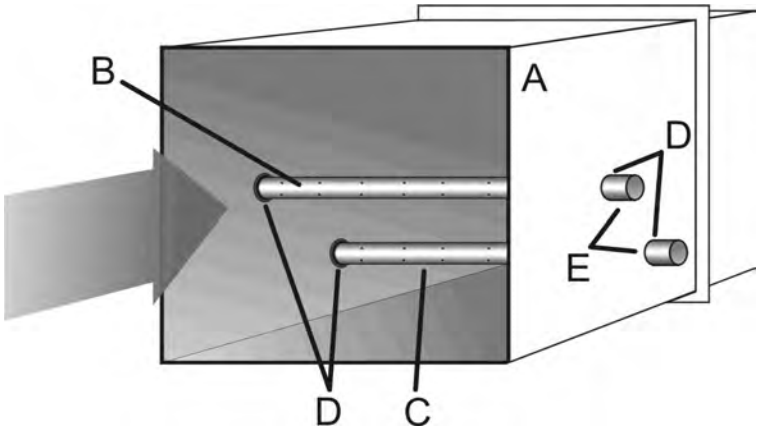

| Legend | |
|---|---|
| **A** | Air flow |
| **B** | Rubber grommet |
| **C** | Sampling pipe |
| **D** | Exhaust pipe |
| **E** | Clear flexible tube |
| **F** | Water is level |

Figure 5-12: Flexible U-tube testing

Face the holes on both pipes to the airflow and slightly rotate the pipes so the water level on both sides of the tube is the same. Mark the position of the pipes' orientation on the pipe and the side of the duct. Connect the detector after securing the pipe network.

**Sampling probe installation:**

1. Drill holes through the sides of the duct so that the intake probe can be inserted across the width of the duct. The holes should be in the middle of the duct.
2. Drill the required number (and size) of sampling holes in the probe. Make a mark on the end of the probe in line with the holes.
3. Insert the probe through the duct, and attach an end-cap without a hole in it.
4. Use the mark on the end of the probe to ensure that the holes on the probe face 20° to 45° above or below the direction of the airflow.
5. Ensure that the holes where the intake probe enters and exits the duct are properly sealed and made air tight.
6. Join the sampling probe to the sampling pipe network running to the detector.




| Legend | |
|---|---|
| **A** | Air duct |
| **B** | Air intake probe |
| **C** | Air exhaust probe |
| **D** | Grommets (sealed) |
| **E** | End caps without a hole |

Figure 5-13: Return air duct sampling

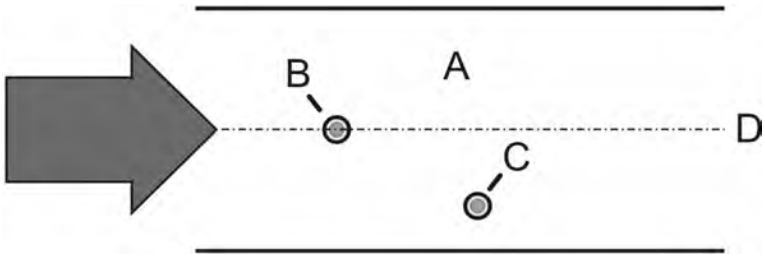
**Exhaust probe installation:**

Always install the sampling probe, then install the exhaust probe.

1. On the same side of the duct that the sampling probe was inserted you will need to drill another hole for the exhaust probe. The hole should be:

- Downwind of the sampling probe by at least 300 mm (1 ft.)
- A quarter the height of the duct up from the bottom. This is done so that the air hitting the exhaust probe has not been disturbed by hitting the sampling probe first.

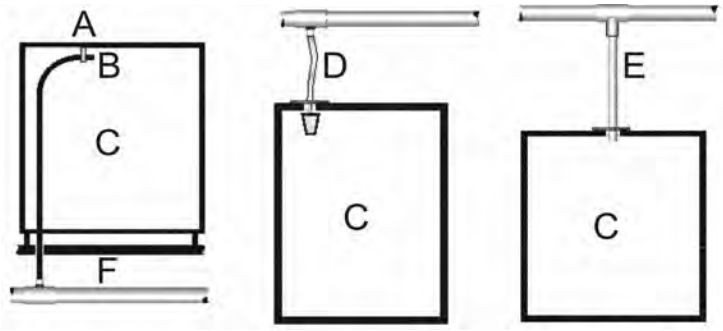
1. Drill the same number (and size) of sampling holes used in the sampling probe. Make a mark on the end of the probe in line with the holes.
2. Attach an end-cap (without a hole), and insert the probe a third the way into the duct.
3. Use the mark on the end of the probe to ensure that the holes on the probe face 20° to 45° above or below the direction of the airflow. These holes need to face the same direction as those used in the sampling probe.
4. Ensure that the hole where the exhaust probe enters the duct is properly sealed and made air tight.
5. Join the exhaust probe to the exhaust pipe network running from the detector.




| Legend | |
|---|---|
| **A** | Air duct |
| **B** | Air intake probe |
| **C** | Air exhaust probe |
| **D** | Central air flow |

Figure 5-14: The location of probes in duct

# 5.3 Cabinet and Rack Detection




| Legend | |
|---|---|
| **A** | Retainer clips |
| **B** | Sampling hole |
| **C** | Equipment cabinets |
| **D** | Capillary tubes |
| **E** | Rigid drop pipe |
| **F** | Under floor void |

Figure 5-15: In-cabinet sampling using capillaries & drop pipes

## 5.3.1 In-Cabinet Installation

In-Cabinet sampling uses capillary tubes, microbore or drop pipes to sample the air from within a cabinet, such as a switching console or an equipment rack. A capillary tube or microbore can be inserted into the cabinet either from the top of the cabinet, or from the under floor void.

**Warning:** Ensure that the power is switched off prior to commencing work on the cabinet. Make sure that there are no electrical wires that may be damaged while drilling the hole.

**Caution:** Check to see that dust or debris such as metallic shavings from drilling the holes will not damage the equipment.

**In-Cabinet sampling installation from the top:**

1. Determine the entry point into the cabinet - Drill an appropriate size hole in the cabinet top, or use an existing cable entry port.
2. Install the sampling pipe using Tee adaptors where the capillary tubes or drop pipes are to be run to the cabinet.
3. Attach appropriate sized reducing connection to the Tee.
4. Attach capillary tube or drop pipes to the reducing connector.
5. Run the capillary or the drop pipe into the cabinet.
6. Unless specified otherwise, insert the capillary tube or drop pipe just below the interior of the cabinet top to a depth of 25 mm to 50 mm (1 to 2 inches).
7. Attach sampling point fitting to ensure the correct sampling hole size.

**Note:** Microbore installations only require steps 1 and 5 to 7.

**In-Cabinet sampling installation from under the floor:**

**Warning:** Ensure that the Power is switched off prior to commencing work on the cabinet. Make sure that there are no electrical wires that may be damaged while drilling the hole.

**Caution:** Check to see that dust or debris such as metallic shavings from drilling the holes will not damage the equipment.

1. Determine the entry point into the cabinet - Drill an appropriate size hole in the cabinet floor, or use an existing cable entry port.

2. Install a sampling pipe as per the guidelines for Floor Void Installation in Section 5.1.3 on page 19, but do not drill sampling holes unless specified in the pipe network design or IDP specifications.
3. Use Tee adaptors where the capillary tubes or drop pipes need to be attached.
4. Fix appropriate sized reducing connection to the Tee.
5. Attach capillary tube or drop pipe to the reducing connector.
6. Run the capillary or the drop pipe into the cabinet.
7. Ensure that the capillary tube or drop pipe runs right to the top of the cabinet and is supported there by a mounting clip or pipe clamp.
8. Unless specified otherwise, the sampling hole should be 25 mm to 50 mm (1 to 2 inches) below the top of the cabinet.
9. Attach sampling point fitting to ensure the correct sampling hole size.

**Note:** Microbore installations only require steps 1 and 6 to 9.

### 5.3.2 On-Cabinet

The sampling pipe is installed directly over the cabinets that need monitoring. The sampling holes are drilled so that they face into the air stream from the cabinet. Each cabinet must have at least one dedicated sampling hole. The installation guidelines for on-cabinet sampling are the same as for Return Air Grilles and Air Ducts (refer to Section 5.2 on page 21).

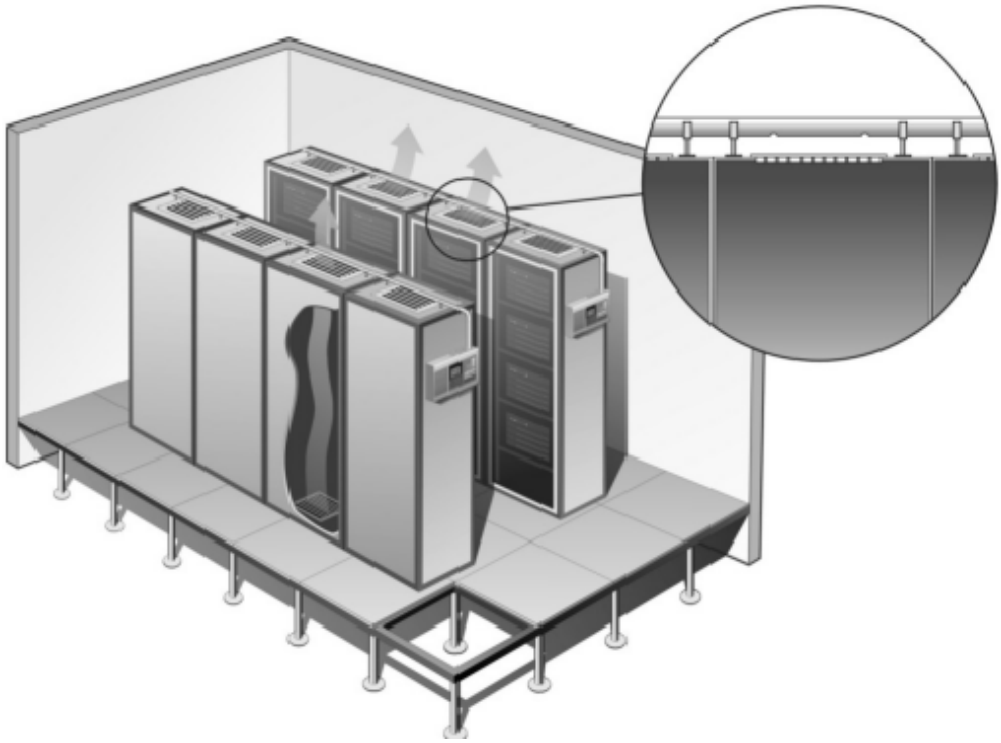


Figure 5-16: On-cabinet sampling

### 5.3.3 In-Rack Installation

In rack installations are typically found in warehouses and other areas using high-bay racking. The sampling pipe is installed in between two racks along their length, or within the racking. Pipes may need to be fitted at different heights to enable effective detection of any incipient smoke at different levels. Instructions for installing the sampling pipe:

1. Whenever possible lay the pipe between two racks so that it can not be accidentally damaged as items are moved into and out of the racks. Typically this would be along the inside of the horizontal and vertical support beams and posts.
2. Secure the sampling pipe to the support beams and post using appropriate support, for example mounting clamps or self locking ties.
3. Drill sampling holes as specified in the pipe network design or the IDP following the guidelines in Section 4.6 on page 15.
4. Connect, but do not glue or bond the sampling pipes to the detector. There must not be any bends in last 500mm (20in) running into the detector.
5. Update the grid overlay and IDP with any changes made to the original plans.
6. After all the tests have been completed bond the pipes together using the appropriate cement solvent. Do not glue the pipes to the detector pipe inlet.
7. Use appropriate labels and tag the sampling pipe, sampling holes and test points where required.

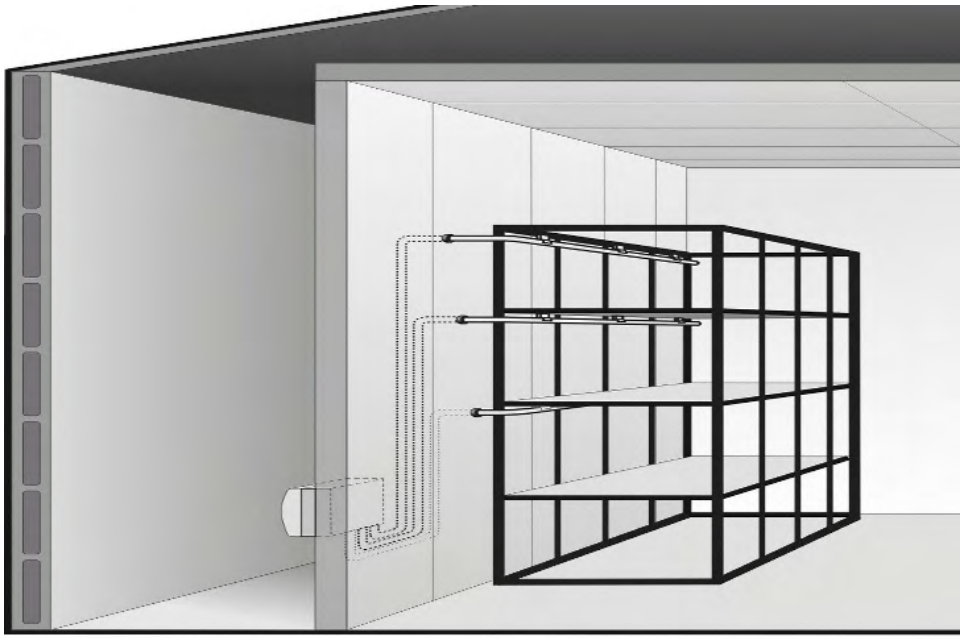


Figure 5-17: In-rack Installation

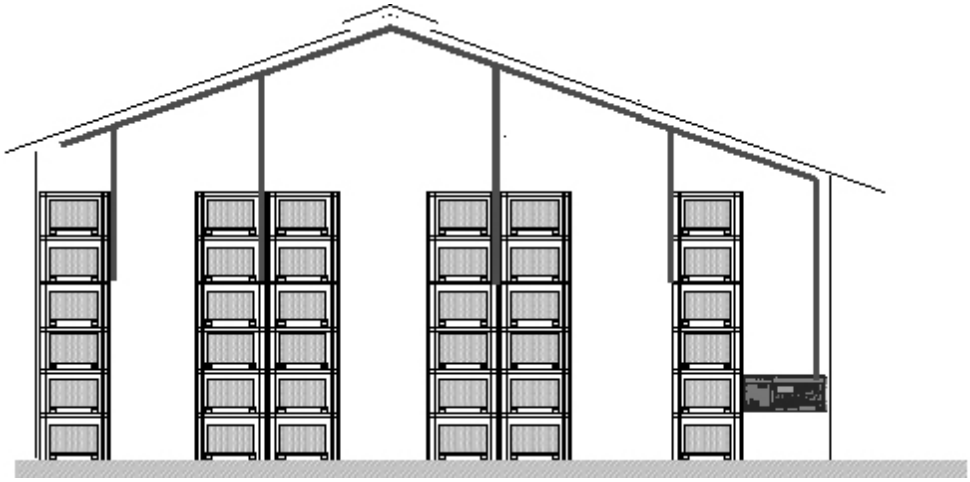
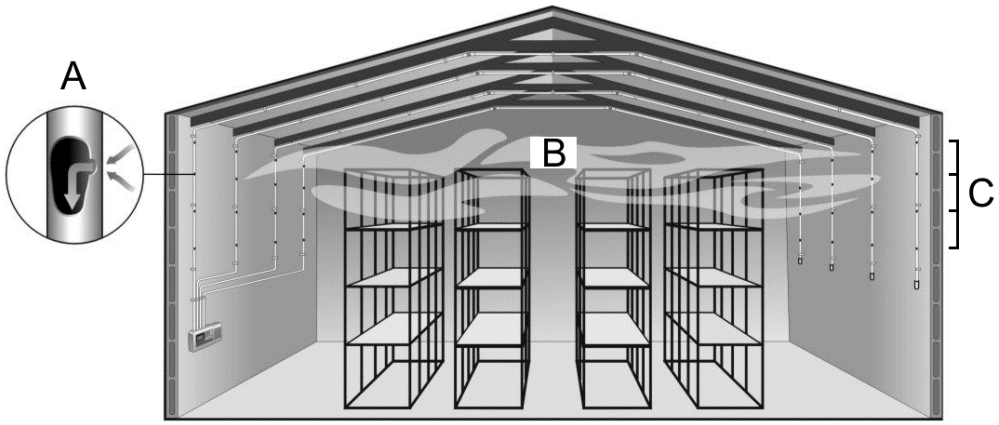


Figure 5-18: Installation between racking

# 5.4 Open Spaces

## 5.4.1 Vertical Sampling Pipe Installation

Vertical installation of sampling pipes is used to sample air at different layers to offset the effects of stratification. Vertical sampling is typically used in areas that have high ceilings. In addition to On-ceiling sampling, pipes are also installed vertically ensuring that air can be sampled at different heights. To install Vertical sampling pipes follow the guidelines for Ceilings and Floors in Section 5.1 on page 17.




| Legend | | | | | |
|---|---|---|---|---|---|
| **A** | Detail of sampling hole | **B** | Stratified smoke layer | **C** | Vertical sampling holes |

Figure 5-19: Vertical sampling

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# 6 Recording Pipe Network Details

Once you have finished installing the pipe network you will need to update the design documents with any modifications. It is critical that you record any changes from the original plan for the commissioning and testing phases at the site.

If significant changes to the original plan were required you should retest the new proposed pipe network before installing it. Failure to retest the design with ASPIRE2 may lead to the installation of a pipe network that does not meet customer and local fire authority codes and standards.

After updating the design documents you must give a copy to the person who will be commissioning the system. The details of the person who will be commissioning can usually be found in the ASPIRE2 Installation Data Pack (IDP).

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